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ABSTRACT

A State Curiosity Scale (SCS) was developed to be a self-reporting measure of a student's level of specific epistemic curiosity aroused by learning materials. The state of epistemic curiosity was conceptualized as a transitory emotional or motivational condition of the student, the arousal level of which was expected to vary across time, both with the nature of the specific learning task and the student's personality characteristics. A high curiosity state level has been found to overcome a high anxiety level and thus to improve the conditions for learning. In order to assess the reliability and validity of the SCS two empirical studies were conducted with undergraduate students. The results of these studies, along with other supporting evidence indicated that the SCS was potentially a valid measure of state curiosity. (JY)

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TECH MEMO

THE DEVELOPMENT OF A MEASURE OF

STATE EPISTEMIC CURIOSITY

Barbara L. Leherissey

Tech Memo No. 34
May 3, 1971

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Abstract

The development of a theoretically-derived measure of state epistemic curiosity, the State Curiosity Scale (SCS), was described. Reliability and validity data was collected in two empirical studies with female undergraduate students. Alpha reliability coefficients of .87 in Study I and .89 in Study II were found. Concurrent validity findings included a significant positive correlation between the SCS and the Ontario Test of Intrinsic Motivation (OTIM), a trait measure of specific curiosity. That is, Ss high in trait curiosity were found to have higher levels of state curiosity than Ss low in trait curiosity. Indirect evidence of the construct validity of the SCS were the findings of a significant negative correlation between state epistemic curiosity and state anxiety, and a significant positive correlation between state epistemic curiosity and performance in a Computer-Assisted Instruction (CAI) learning task.

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Researchers in the area of personality processes which effect learning behavior in a wide variety of situations have recognized the necessity for distinguishing between personality traits and personality states (e.g., Day, 1969a; Spielberger, 1966). Whereas traits imply relatively stable personality predispositions, states imply transitory emotional conditions which fluctuate over time as a function of situational and experiential factors. It becomes evident that state variables are more closely related to an individual's behavior in a particular situation (e.g., O'Neil, Spielberger, & Hansen, 1969; O'Neil, Hansen, & Spielberger, 1969); and to properly assess the effects of particular affective states, measures which reflect feelings of an individual at a particular time are required.

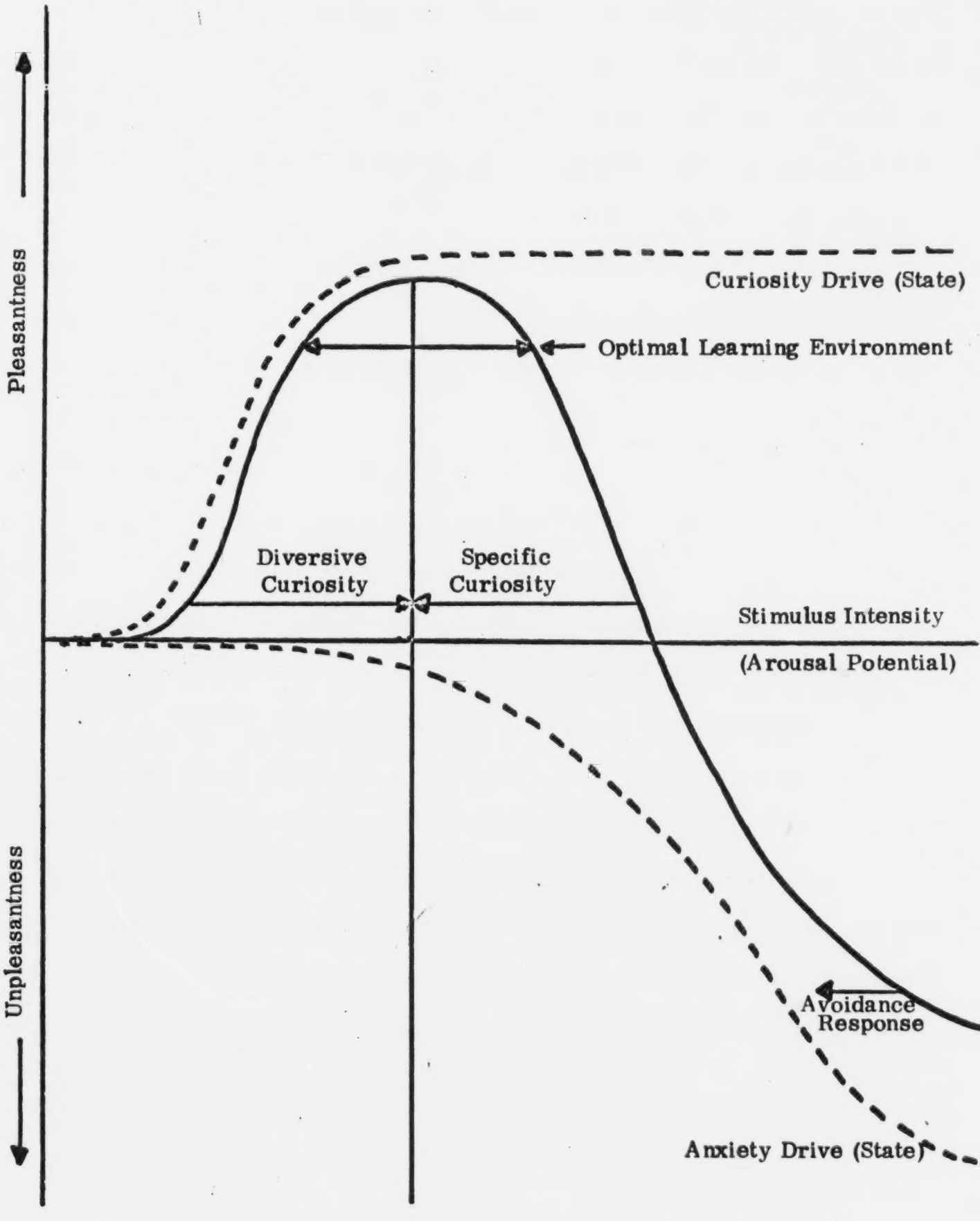
One affective variable which has particular relevance for motivation and learning is curiosity. In general, Berlyne (1960) has defined curiosity as a motivational condition which results from collative variability or incomplete absorption of information about a particular stimulus. Recent research evidence from a variety of sources now suggests that the presence of curiosity behaviors enhances the acquisition of knowledge (e.g., Berlyne, 1960, 1967, 1971; Day, 1967, 1969a; Piaget, 1968). The particular type of curiosity most relevant to the learning process is epistemic or knowledge-seeking curiosity behavior, which may exist as either a personality trait or a transitory state.

The relevance to education of a measure of state epistemic curiosity is predecated on the basis of empirical evidence which indicates an inverse

relationship between curiosity and anxiety (Day, 1969b; Lester, 1968; Maslow, 1963; Penney, 1965). That is, when levels of curiosity are high, levels of anxiety are relatively low, suggesting that experimental manipulation and precise measurement of curiosity could lead to the discovery of optimal feeling states (i.e., curiosity) which would form the basis for optimal performance. In addition, the impressive literature which has demonstrated the debilitating effects of anxiety on performance and cognitive functioning (e.g., Borkowski & Mann, 1969; Hodges & Spielberger, 1969; Sarason, Lighthall, Waite, & Ruebush, 1960; Sieber, 1969) is evidence of the educational importance of identifying those variables essential to an optimal learning environment.

A theoretical model which specifies predicted relationships between types of curiosity, anxiety, performance, and optimal feeling states has been formulated by Berlyne (1971) and Spielberger & Butler (1971)[1]. This model has been named the Optimal Degree of Arousal Model (Leherissey, 1971) and is graphically shown in Figure 1. Several points should be noted in connection with this theoretical model: 1) the aversion threshold (anxiety drive) is higher than the reward threshold (curiosity drive), i.e., more intense increases in arousal activate the aversion system; 2) the inverted-U curve is the additive resultant of the separate reward and aversion systems; 3) both curiosity and anxiety are drive states that motivate the organism and which are activated by moderate or high degrees of arousal, respectively[2]; 4) diversive curiosity is rewarding through increases in stimulation toward the optimal level, whereas specific curiosity is rewarding through decrease in stimulation toward the optimal level; 5) specific curiosity is anxiety-reducing, whereas diversive curiosity tends to lead to increases in anxiety;

Figure 1. The Optimal Degree of Arousal Model



and 6) an optimal degree of arousal exists for learning, in that performance is best under conditions of moderate or optimal degrees of arousal (i.e., curiosity). The empirical evidence supporting these predicted relationships has been reviewed by Leherissey (1971), who reports that both optimal feeling states and optimal performance are associated with an intermediate level of arousal or curiosity drive.

To date, however, no measures of state curiosity exist in the experimental literature. The present study represents a research effort to develop a theoretically-derived state measure of epistemic curiosity. The theoretical framework which guided the development of this scale was the conceptual distinctions made by Berlyne (1960) and Day (1969a) regarding major classes of curiosity behaviors. Table 1 summarizes and defines these classes of curiosity behaviors. A complete description of the theoretical concepts which guided the development of a measure of state epistemic curiosity is given in the following sections.

Rationale and Procedures for Construction

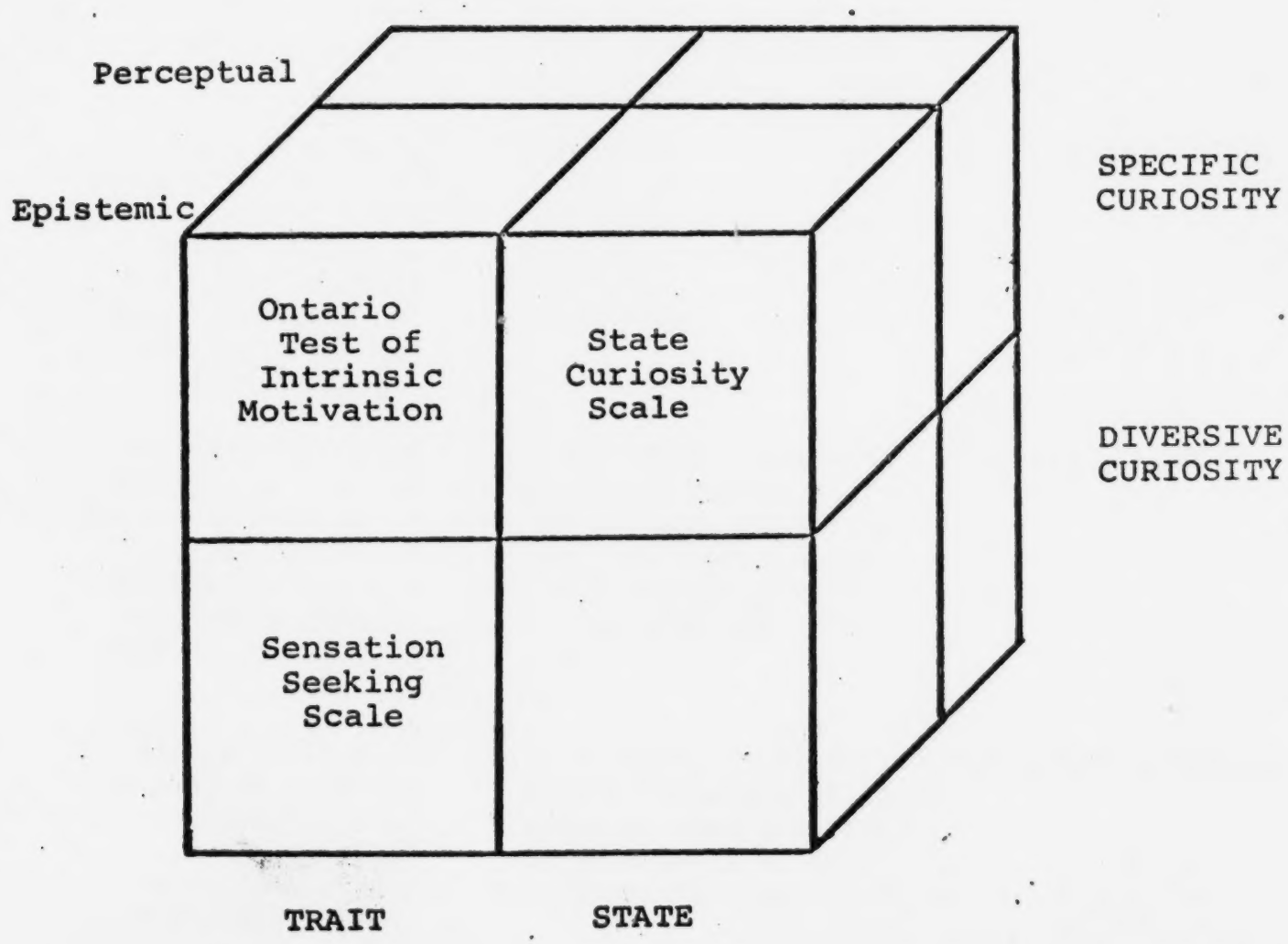
The State Curiosity Scale (SCS) is a self-report scale for measuring the concept of state epistemic curiosity. The relationships between this concept and other curiosity concepts is illustrated in Figure 2, along with the existing instruments for measuring these curiosity concepts. Although inventories exist for measuring the traits of specific and diversive curiosity, the SCS represents the first state measure of a particular type of

Table I

The Interrelationships between Major Classes of Curiosity Behaviors

Curiosity Behaviors	Definitions	
	State	Trait
Specific Curiosity	Transitory state characterized by actively seeking to reduce subjective uncertainty by specific exploratory acts; induced by state of incomplete information regarding specific stimuli.	Relatively stable tendency or personality predisposition to engage in specific exploration under conditions of subjective uncertainty.
a) Epistemic	Transitory state of specific curiosity characterized by seeking to reduce subjective uncertainty by a quest for particular knowledge.	Relatively stable tendency or personality predisposition to engage in specific knowledge-seeking behaviors under conditions of conceptual conflict.
b) Perceptual	Transitory state of specific curiosity characterized by seeking to reduce subjective uncertainty by exposure to particular stimuli.	Relatively stable tendency or personality predisposition to engage in specific exploration of stimuli under conditions of perceptual conflict.
Diversive Curiosity	Transitory state of curiosity characterized by actively seeking diverse forms of stimulation; induced by a state of boredom.	Relatively stable tendency or personality predisposition to engage in diversive stimulation-seeking behaviors under conditions of boredom.

Figure 2. Concepts of Curiosity Behaviors and their associated Measurement Instruments



specific curiosity --- epistemic curiosity. The importance of having a measure of a student's level of epistemic or knowledge-seeking curiosity becomes evident when one considers the role of this motivational state in learning. As Berlyne (1971) has pointed out, epistemic curiosity behaviors are related to thinking and problem-solving behaviors, and can lead to permanent storage of information.

The complete SCS scale consists of 20 statements which require subjects to indicate how they feel at a particular point in time about specific learning materials. Although the instructions for the 20-item SCS scale were originally written to reflect a subject's feelings while he was learning a particular set of materials, the instructions can be altered to reflect a subject's feelings prior to learning a set of materials, e.g., "How do you think you will feel while learning these materials." Thus, the SCS can be used to periodically measure changes in state epistemic curiosity which occur during the learning process.

The prototype for the development of the SCS was the State-Trait Anxiety Inventory (STAI) developed by Spielberger, Gorsuch & Lushene (1970). In addition, the conceptualization of state epistemic curiosity was guided by Berlyne's (1960) definitions of types of curiosity behaviors, the Optimal Degree of Arousal Model (Berlyne, 1971; Spielberger & Butler, 1971)[1], Day's (1969) conceptual distinction of curiosity as both a trait and a state of the human organism, and the theoretical framework of the Trait-State Anxiety Theory (Spielberger, 1966). The concept of state epistemic curiosity which guided the development of the SCS will be discussed in the following section.

Concept of State Epistemic Curiosity

The 20-item State Curiosity Scale was developed for the purpose of assessing a student's level of specific epistemic curiosity aroused by the learning materials. The state of epistemic or knowledge-seeking curiosity was conceptualized as a transitory emotional or motivational condition of the student, the arousal level of which was expected to vary across time, both with the nature of the specific learning task and the student's personality characteristics or predispositions.

A conceptual distinction was made between specific and diversive curiosity. Whereas diversive curiosity was assumed to refer to that behavioral state in which the individual actively seeks out stimulation regardless of content and which is induced by a state of boredom, specific curiosity was assumed to refer to that behavioral state in which the individual actively seeks to reduce his subjective uncertainty regarding specific stimuli and which is induced by incomplete information (Berlyne, 1960). Of the two types of specific curiosity (epistemic and perceptual), the scale was developed to measure epistemic or knowledge-seeking behaviors rather than perceptual curiosity behaviors stimulated by perceptual conflict in that these epistemic behaviors can lead to the permanent storage of information (Berlyne, 1971).

An epistemic curiosity state was felt to be characterized by a moderate or optimal degree of tension, excitement or arousal, associated with pleasant hedonic feelings and approach behaviors toward a novel or unfamiliar learning task. Pleasant hedonic feelings were assumed to be related to whether

a student felt the materials were "interesting", "fun", "exciting", "enjoyable", and/or "fascinating." State epistemic curiosity behaviors were further assumed to be related to a student's desire to: 1) know more about a learning task; 2) approach novel or unfamiliar learning tasks; 3) approach a complex or ambiguous learning task; and 4) persist in information-seeking behavior in a learning task.

The state of epistemic curiosity was assumed to be conceptually distinct from the trait of epistemic curiosity, in that the state is both more transitory and situation-specific. The trait of epistemic curiosity, on the other hand, was assumed to reflect relatively stable individual differences in 1) the extent to which an individual notices anomalies in the environment, i.e., demonstrates a sensitivity to problems; 2) the extent to which an individual is disturbed by the anomalies he perceives; and 3) the extent to which an individual is inclined to resort to exploration and epistemic behavior rather than withdrawal from the situation (Berlyne, 1971). Thus, the tendency for an individual to experience a state of epistemic curiosity was assumed to be dependent on his personality predisposition to be inclined favorably toward inconsistent or incongruous elements in the environment, which in turn, was dependent on his past experiences and personality structure.

In general, an individual with a high level of trait curiosity would be expected to respond with higher levels of state curiosity more frequently in specific learning situations than an individual with a low level of trait curiosity. Individuals high in trait curiosity would also be expected to respond to conceptual conflict with increased state epistemic curiosity intensity in specific learning tasks perceived as within an optimal adaptation range, i.e., a situation which produces a conflict that the individual feels

he can master or solve. In addition, it would be expected that individuals with a high level of state epistemic curiosity in a specific learning situation would perform better than individuals with a low level of state epistemic curiosity.

Description of Scale Construction

The SCS is a self-report scale for measuring the state of epistemic curiosity. The scale was developed primarily as a research instrument for investigating the relationships between this curiosity concept, state anxiety, and performance in a learning task. Subjects are asked to respond to 20 statements which indicate how they feel about the learning materials at a particular moment in time. The instructions can be altered to reflect how an individual thinks he will feel while learning new materials (Form A) or how he felt while learning the materials (Form B). The range of the SCS varies from a minimum possible score of 20 to a maximum score of 80. The subjects respond to each item on a four-point scale ranging from (1) Not at all, (2) Somewhat, (3) Moderately so, to (4) Very much so. Some of the items on the SCS are reversed in order to reduce possible response set effects and provide items for which high ratings can indicate low state epistemic curiosity. These reversed items are 3, 5, 9, 11, 14, and 15. (See Appendix B for revised scales, Form A and Form B).

The steps in the development of the SCS and the procedures used to select and construct items included: 1) several items on the Ontario Test of Intrinsic Motivation (OTIM; Day, 1969a) which had face validity for the concept of epistemic curiosity were rewritten so as to retain the

psychological content of the item but altered in content and form so that the item could be used with state instructions toward learning materials; 2) the remaining items were constructed by the author to reflect an individual's desire to a) know more about a learning task; e.g., "I thought it was fun to increase my understanding about the subject matter." b) approach a novel or unfamiliar learning task; e.g., "I enjoyed learning the material which was unfamiliar to me." c) approach a complex or ambiguous learning task; e.g., "I found I would rather spend time answering difficult questions than spend it with easy ones." d) persist in information-seeking behavior in a learning task; e.g., "When I came across a word I didn't understand, I tried to figure out its meaning." The 20-item scale was administered to students in two studies which will be described in the following section.

Description of Validation Studies

In order to assess the reliability and validity of the State Curiosity Scale (SCS), two studies were conducted. In the first study, state curiosity was measured in response to a Computer-Assisted Instruction (CAI) experiement, whereas in the second study, state curiosity was measured in response to an undergraduate health education course. The procedures and results of these two studies will be discussed separately; the first study will be discussed in greater detail due to its more complex experimental design.

Study I

Subjects. 128 female undergraduates enrolled in psychology classes in which participation in a learning experiment was a course requirement were used as Ss. The Ss were randomly assigned to four conditions: reading-long (R-L), reading-short (R-S), constructed response-long (CR-L), and constructed response-short (CR-S) on the basis of their level of trait anxiety (low, medium, or high).

Apparatus. An IBM 1500 system was used to present the learning materials and STAI A-State scales. Terminals for this system consist of a cathode ray tube (CRT), light pen, and typewriter keyboard.

Learning Program and Achievement Measures. The R and CR instructional programs described by Leherissey, O'Neil & Hansen (1971) were renamed the R-L and CR-L and divided into two additional short versions. The short versions contained the same subject matter and frame structure as their longer counter-parts, but terminated at the beginning of the technical pictorial frames containing electrocardiogram (EKG) drawings. The learning materials and post-test were divided into familiar (F), initial technical (T_I), and remaining technical (T_R) sections; the pretest covered only the F materials. Ss in the long versions received the F and T_I materials and Ss in the long versions received the F, T_I, and T_R materials on both the learning program and posttest. The pre and post achievement measures were the same as those used by Leherissey et al. (1971) except that the R-S and CR-S posttest contained only the F and T_I items covered in the shortened versions of the instructional program.

In the R versions of the instructional program, Ss were not required to make any overt responses, but merely to read each frame successively. In the CR versions, overt responses were required in the form of a typed word for response blanks on the familiar and technical verbal materials. On the technical pictorial materials containing EKG drawings, Ss "constructed" EKG drawings by special program coding.

Affective Measures. The State-Trait Anxiety Inventory (STAI) developed by Spielberger et al. (1970) was used to measure both A-Trait and A-State. The Multiple Affect Adjective Check List (MAACL; Zuckerman & Lubin, 1965) was used to assess S's hostility toward the learning task. The State Curiosity Scale (SCS; Leherissey, 1971) was used to measure how curious Ss felt while they were learning the CAI materials. Selected subscales of the Ontario Test of Intrinsic Motivation, (OTIM; Day, 1968) were used to assess how curious Ss were in general. The response format of the OTIM was altered to include the response categories of the STAI A-Trait scale, i.e., Ss rated themselves on a four-point scale ranging from (1) Almost never, (2) Sometimes, (3) Often, and (4) Almost always. Thus, the range of possible scores on the OTIM was from 109 to 436. (See Appendix A for the original version of the SCS.)

Procedure. The experimental session was divided into three periods: 1) a Pre-Task Period, during which Ss were administered the A-Trait scale, took the achievement pretest and short form (5-item) STAI A-State scale, and were assigned to treatment groups; 2) a Performance Period, during which Ss learned the Familiar and Technical CAI materials and took three or four short form A-State scales depending on whether they were in the short or long versions, respectively. Ss in the long versions received an A-State scale at the end of the T_I materials to enable a comparison of the A-State of all Ss up to that point; 3) a Post-Task Period, during which Ss were administered the MAACL hostility scale, posttest, short form A-State scale, SCS and OTIM.

Reliability Data. The alpha reliability coefficient for the 20-item SCS was found to be .82, with a mean of 48.80 and a standard deviation of 9.39. Both item-remainder and item-total reliabilities for the individual items were calculated and are reported in Table 2. Items which were found to have item-remainder correlations of less than .30 were dropped, which resulted in a 16-item scale. The alpha reliability coefficient for this scale was found to be .87, with a mean of 40.27 and standard deviation of 9.14. The item-remainder and item-total correlations for the 16-item scale are also given in Table 2.

Table 2

Means, Standard Deviations, Item-Remainder and Item-Total Reliabilities for the 16- and 20-item State Curiosity Scales (N=128)

			ITEM REMAINDER		ITEM TOTAL	
			16-item	20-item	16-item	20-item
ITEM	MEAN	SD	Scale	Scale	Scale	Scale
1	2.76	.96	.65	.63	.71	.69
2	2.74	1.00	.68	.65	.74	.71
3	3.06	.89	.53	.50	.60	.57
4	2.64	1.06	.34	.38	.46	.47
5	2.76	1.03	.71	.68	.76	.73
6	2.34	.96	.58	.57	.64	.64
7	2.17	1.05	.50	.53	.57	.61
8	2.58	.97	.76	.74	.80	.78
9	3.27	.91	.36	.33	.44	.42
10	2.88	.94	.66	.62	.70	.68
11	2.12	1.05	.40	.38	.50	.46
12	2.97	.90	.44	.41	.51	.49
13	2.15	1.01	.33	.31	.45	.41
14	2.36	.97		.11		.21
15	1.91	1.06	.25	.28	.34	.39
16	1.93	1.02		-.02		.09
17	2.32	1.04		-.16		-.05
18	1.92	.88		.10		.19
19	1.96	.90	.49	.47	.56	.55
20	1.96	1.02	.44	.48	.54	.56

Validity Data. Partial evidence of the concurrent validity of the SCS is provided by the correlations between the SCS and the OTIM. In this study, the OTIM was found to have an alpha reliability coefficient of .91. The correlations between the 16 and 20-item SCS, subscales of the OTIM, and the total OTIM scores are reported in Table 3. It should be noted that the SCS was found to correlate significantly with a majority of

Table 3

Correlations of State Curiosity Scale with the Ontario Test of Intrinsic Motivation (N=128)

OTIM Scales	Mean	SD	Correlation 16-item Scale	Correlation 20-item Scale
Ambiguity	76.46	11.26	.25*	.26*
Complexity	71.33	9.64	.40*	.41*
Novelty	75.90	13.48	.11	.11
Ambiguity-Thinking	25.00	3.84	.22	.24
Ambiguity-Consultation	25.34	4.07	.14	.14
Ambiguity-Observation	24.98	3.93	.33*	.36*
Complexity-Thinking	26.59	4.04	.26*	.27*
Complexity-Consultation	22.12	3.91	.41*	.40*
Complexity-Observation	24.53	4.12	.32*	.35*
Novelty-Thinking	27.73	3.89	.25*	.28*
Novelty-Consultation	22.63	4.13	.45*	.44*
Novelty-Observation	22.85	4.12	.34*	.35*
Diversive Curiosity	23.41	4.33	.18	.20
Social Desirability	22.77	4.41	.39*	.40*
Scientific Interest	22.92	3.56	.29*	.32*
TOTAL	269.98	32.65	.41*	.43*

Correlations underlined are significant at the $p < .05$ level; correlations followed by an asterisk are significant at the $p < .01$ level.

the OTIM subscales and to have a moderately high positive correlation with the total OTIM scores (i.e., r=.41 for the 16-item scale and .43 for the 20-item scale, p<.01). These correlations are within the range of correlations found between another measure of traits and states, the STAI (Spielberger et al., 1970). In addition, the low positive correlations between the SCS and the Diversive Curiosity subscale of the OTIM provides some indirect evidence that the SCS is a measure of specific rather than diversive curiosity.

To further explicate the correlations between the OTIM and SCS, an analysis of variance (ANOVA) was calculated to determine the effects of trait curiosity (low, medium, high), response modes (reading, constructed response), and program length (long, short) on state curiosity scores. The Ss were divided into low, medium, and high trait curiosity groups by ranking the distribution of OTIM scores and dividing this distribution into thirds. The R-S, R-L, CR-S, and CR-L students were then separated out of this dis-tribution, yielding an unequal but proportional N in each group. The range of low trait curiosity scores was 177-254; medium trait curio-sity scores ranged from 255-283; the range of high trait curiosity scores was 284-369. The dependent measure in this analysis was scores on the 16-item SCS. Since a similar analysis using the 20-item SCS scores as the dependent measure yielded the same statistical conclusions, this analysis is not reported.

Results of the ANOVA on SCS scores indicated that high trait curious Ss ($\bar{X}$=44.61) had higher state curiosity scores than medium ($\bar{X}$=40.90) or low ($\bar{X}$=35.57) trait curious Ss. This main effect of trait curiosity was significant at the p<.001 level (F=14.15, df=2/116).

No other main effects or interactions were significant. However, there was a tendency for Ss in the reading groups ($\bar{X}$=41.47) to have higher state curiosity scores than Ss in the constructed response ($\bar{X}$=39.33) groups (F=3.76, df=1/116, p<.10).

Evidence which can be considered to bear on the construct validity of the SCS is provided by the correlations of the SCS with the STAI A-Trait and A-State scales. As can be inferred from the Optimal Degree of Arousal Model (See Figure 2), an inverse relationship exists between states of curiosity and states of anxiety; and thus, a negative correlation between these two states would be expected. The correlations for both the 16 and 20-item SCS and the STAI scales are given in Table 4. Several things should be

Table 4

Correlations of State Curiosity Scale with the State-Trait Anxiety Inventory Scales (N=128)

STAI Scales	Mean	SD	Correlation 16-item Scale	Correlation 20-item Scale
A-Trait	38.66	8.35	-.02	-.05
Pretest A-State	9.93	3.67	-.06	-.10
Pretask A-State	10.73	3.48	-.15	-.19
Familiar A-State	9.42	3.60	-.22	-.26*
Technical Short A-State	9.99	4.28	-.27*	-.30*
Technical Long A-State	10.44	4.54	-.36*	-.38*
Posttest A-State	10.74	4.23	-.22	-.23

Correlations underlined are significant at the p<.05 level; correlations followed by an asterisk are significant at the p<.01 level.

noted concerning the correlations reported in Table 4: 1) although there is no correlation between A-Trait and state curiosity, all correlations with A-State are in the predicted direction, i.e., state anxiety and state curiosity are inversely related; 2) the strong-

est negative correlations between state anxiety and state curiosity are during the more difficult sections of the task, i.e., during and after the CAI learning task and posttest, whereas there is little relationship between these variables on the pretest and pretask measures. These data may be interpreted as due either to the fact that state curiosity was measured at the end of the experimental session and would thus be expected to correlate more highly with those measures given close in time, or the fact that when students are instructed to indicate their feelings toward difficult learning materials, both state curiosity and state anxiety responses are evoked. The finding of no correlation between A-Trait and state curiosity and the additional finding of no correlation between the SCS and OTIM ($r = .08$) indicates that 1) the predisposition to manifest a state of anxiety is not related to state curiosity and 2) the predisposition to manifest states of anxiety is not related to predispositions to manifest states of curiosity.

Several ANOVA's were computed to investigate further the relationships between the SCS, response modes, program length, and STAI A-State scales. The Ss were divided into low, medium, and high state curiosity groups by ranking the distribution of SCS scores and dividing this distribution into thirds. The R-S, R-L, CR-S, and CR-L groups were then separated out of this distribution, yielding an unequal N in each group. The range of low state curiosity scores was 18-36; medium state curiosity scores ranged from 37-44; the range of high state curiosity scores was 45-62. Dependent measures in the ANOVA's calculated were Pretest A-State, Pretask A-State, Familiar A-State, Technical Short A-State, Technical long

A-State, and Posttest A-State. As in the previously reported ANOVA's, findings with the 20-item SCS yielded the same statistical conclusions and these analyses are not reported.

Results of these series of analyses indicated that 1) there were no effects of SCS levels, response modes, or program length on Pretest or Pretask A-State scores; 2) low state curiosity Ss ($\bar{X}$=10.19) had higher A-State during the Familiar learning materials than medium ($\bar{X}$=9.83) and high ($\bar{X}$=8.38) state curiosity Ss ($F=3.50$, $df=2/116$, $p<.05$); 3) low state curiosity Ss ($\bar{X}$=11.72) had higher A-State during the Technical short learning materials than medium ($\bar{X}$=10.23) and high ($\bar{X}$=8.18) state curiosity Ss ($F=8.07$, $df=2/116$, $p<.01$); 4) during the remaining Technical materials, low state curiosity Ss ($\bar{X}$=12.91) had higher A-State than medium ($\bar{X}$=9.77) and high ($\bar{X}$=8.67) state curiosity Ss ($F=3.58$, $df=2/58$, $p<.05$); 5) there was a tendency for low state curiosity Ss to have higher A-State than medium ($\bar{X}$=10.95) or high ($\bar{X}$=9.42) state curiosity Ss on the posttest ($F=2.71$, $df=2/116$, $p<.10$). In general, therefore, state curiosity and state anxiety were found to be inversely related, particularly on the state anxiety measures taken during the learning task.

Additional evidence bearing on the construct validity of the SCS is provided by the correlations between the STAI A-State scales, MAACL anxiety scale, and the SCS. These correlations are shown in Table 5. As can be seen in Table 5, all of the STAI A-State scales correlate positively with the MAACL Anxiety scale at the $p<.01$ level, which indicates that these scales are measuring a similar construct. In addition, the significant negative correlation between the MAACL anxiety scale and

Table 5

Correlations of State Curiosity Scale and STAI
A-State Scales with Zuckerman
MAACL Anxiety Scale (N=128)

SCALE	Correlations 16-item scale	20-item scale
SCS	-.31*	-.33*
Pretest A-State	.41*	.41*
Pretask A-State	.44*	.44*
Familiar A-State	.55*	.55*
Technical Short A-State	.51*	.51*
Technical Long A-State	.54*	.54*
Posttest A-State	.50*	.50*

Correlations underlined are significant at the $p<.05$ level; correlations followed by an asterick are significant at the $p<.01$ level.

SCS is in the predicted direction and of the same magnitude as the correlations between the SCS and STAI A-State scales shown in Table 4.

As further evidence of the construct validity of the SCS, correlations were computed between the SCS and achievement measures given during the CAI learning experiment. State epistemic curiosity was assumed to facilitate performance and thus it was expected that Ss scoring high on the SCS would make more correct responses on the achievement measures than Ss scoring low on the SCS, i.e., a positive relationship would exist between the SCS and performance. The correlations are reported in Table 6. The significant positive correlations between the SCS and posttest achievement measures are in the predicted direction, in that high state curious Ss tend to perform best on these posttest measures.

Table 6

Correlations of State Curiosity Scale with CAI Learning Task Achievement Measures (N=128)

Achievement Measures	Mean	SD	Correlation 16-item Scale	Correlation 20-item Scale
Pretest	7.84	2.88	-.01	-.00
Familiar Posttest	15.70	3.34	.27*	.27*
Technical Short Posttest	18.12	4.94	.17	.18
Technical Long Posttest	31.53	17.05	.41*	.37*
Technical Total Posttest	49.70	19.68	.36*	.32*

Correlations underlined are significant at the $p<.05$ level; correlations followed by an asterick are significant at the $p<.01$ level.

To further explicate the relationships between the SCS and achievement measures, several ANOVA's were calculated. Results of these analyses indicated that 1) there was no difference in the performance of low, medium, and high state curiosity Ss on the pretest; 2) there was a tendency for low state curiosity Ss ($\bar{X}=14.84$) to make fewer correct responses on the Familiar portion of the posttest than medium ($\bar{X}=15.35$) and high ($\bar{X}=16.84$) state curiosity Ss ($F=2.62$, $df=2/116$, $p<.10$); 3) low state curiosity Ss ($\bar{X}=17.35$) made fewer correct responses on the Technical short portion of the posttest than medium ($\bar{X}=18.68$) and high ($\bar{X}=18.79$) state curiosity Ss ($F=3.63$, $df=2/116$, $p<.05$); 4) on the technical long portion of the posttest, low state curiosity ($\bar{X}=25.09$) Ss made fewer correct responses than medium ($\bar{X}=30.32$) and high ($\bar{X}=39.23$) state curiosity Ss ($F=4.02$, $df=2/58$, $p<.05$). Thus, these analyses tend to support the prediction that superior performance is associated with high levels of state curiosity.

Study II

Subjects and Procedures. Additional reliability and validity data for the State Curiosity Scale was obtained in a second study in which the SCS, Zuckerman (1964) Sensation Seeking Scale (SSS), STAI A-Trait and A-State scales were administered in class to 40 female undergraduate volunteers enrolled in a health education course. Since the SSS was considered to be a measure of diversive curiosity, low positive correlations between the SCS and SSS were expected.

The Ss were instructed to respond to the SCS and STAI A-State scales with how they felt while learning the course material; they were instructed to respond with how they felt in general on the SSS and STAI A-Trait scales. The four items on the SCS which had been dropped from the 20-item scale used in Study I were rewritten to bring the total number of items to 20. The criteria given in the previous section on test construction were used in constructing these four new items. (See Appendix A for the revised scale used in Study II.)

Reliability Data. The means, standard deviations, and alpha reliability coefficients for the SCS and SSS are reported in Table 7. Item-total and item-remainder correlations for the individual items of the SCS are given in Table 8. It should be noted that the

Table 7

Means, Standard Deviations, and Alpha Reliabilities for the State Curiosity Scale and Sensation Seeking Scale (N=40)

SCALE	MEAN	SD	ALPHA
SCS	50.33	9.82	.89
SSS	45.20	5.57	.83

Table 8

Means, Standard Deviations, Item-Remainder and Item-Total Reliabilities for revised 20-item State Curiosity Scale (N=40)

ITEM	MEAN	SD	ITEM REMAINDER	ITEM TOTAL
1	2.65	.82	.73	.77
2	2.90	.74	.58	.63
3	2.90	.77	.36	.43
4	3.07	.88	.25	.33
5	2.72	.84	.79	.82
6	2.25	.86	.77	.80
7	2.63	.94	.49	.56
8	2.77	.79	.70	.74
9	2.88	.87	.63	.68
10	2.67	.85	.55	.61
11	2.32	.93	.33	.41
12	2.80	.71	.29	.36
13	2.17	.77	.48	.54
14	2.72	.95	.47	.54
15	1.90	.89	.37	.45
16	2.38	.86	.21	.29
17	1.90	1.00	.32	.41
18	2.50	.87	.76	.79
19	2.13	1.03	.66	.72
20	2.05	.77	.53	.58

item-remainder and item-total correlations of the revised items (Items 14, 16, 17, and 18) all increased; only item 16 had an item-remainder correlation of less than .30.

Validity Data. The concept of state curiosity measured by the SCS was assumed to be specific epistemic curiosity, and thus conceptually distinct from diversive or stimulation-seeking curiosity whose goal object is not specifiable apriori. Therefore, an indirect test of this assumption and the concurrent validity of the SCS is the correlation of this scale with a measure of diversive curiosity, the Zuckerman (1964) Sensation Seeking Scale (SSS). Since the SSS contains items which load differentially for males and females

(Zuckerman, Kolin, Price & Zoob, 1964) and the sample in this study consisted of undergraduate females only, just those 30 items of the SSS applicable to females were administered. Each item could be answered positively or negatively relative to the trait of diversive curiosity. In the analyses reported, negative items were scored 1 and positive items were scored 2, resulting in a possible range of 30 to 60.

The correlation matrix for the SCS, SSS, STAI A-Trait and A-State scales is shown in Table 8. As can be seen in Table 9, the only significant correlation was found between A-State and A-Trait.

Table 9

Intercorrelations of the State Curiosity Scale, Sensation Seeking Scale, STAI A-State and A-Trait Scales (N=40)

VARIABLES	SCS	SSS	A-STATE	A-TRAIT
SCS	1.00	.17	-.12	.18
SSS		1.00	.14	-.03
A-State			1.00	.30
A-Trait				1.00

Correlations underlined are significant at the $p<.05$ level.

As expected, the SCS was not found to correlate significantly with the SSS. The expected inverse relationship between A-State and the SCS was found, although this correlation did not approach significance. Caution should be taken in interpreting these correlations, however, due to the fact that the sample size used was small and the fact that responses to the SCS and SSS reflected feelings toward the course materials as a whole. Thus, it is possible that more generalized states of anxiety and curiosity toward course material were being measured, which may have accounted for the failure to find a significant negative correlation between these variables.

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Footnotes

[1]The relationships between diversive curiosity, specific curiosity, and state anxiety shown in Figure 1 were further elaborated by Dr. C. D. Spielberger and T. F. Butler in a graduate seminar presented by Dr. D. E. Berlyne at Florida State University, Psychology Department, February 11, 1971

[2]Whereas Berlyne (1960; 1967), Day (1969a) and Leherissey (1971) view curiosity and anxiety as drive states activated by moderate or high levels of arousal, respectively, Spielberger & Butler have postulated a different theoretical position on the relationship between curiosity and anxiety. In essence, Spielberger & Butler maintain that curiosity, and anxiety are separate, antagonistic drive states activated by separate reward and aversion systems.

APPENDIX

A

ORIGINAL VERSIONS OF THE STATE CURIOSITY SCALE USED IN STUDIES I AND II

SCS: STUDY II

Name _____ Date _____

DIRECTIONS: A number of statements which people have used to describe themselves are given below. Read each statement and then circle the appropriate number to the right of the statement to indicate how you felt while learning the materials.

There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to best describe how you felt.

	Not at all	Somewhat	Moderately So	Very much so
1. The material I learned was very interesting to me.	1	2	3	4
2. I enjoyed learning the material which was unfamiliar to me.	1	2	3	4
3. I felt that the material was boring.	1	2	3	4
4. When the material was difficult, I did not enjoy learning it.	1	2	3	4
5. I thought it was fun to increase my understanding about the subject matter.	1	2	3	4
6. I would enjoy reading more about this subject matter.	1	2	3	4
7. I would like to see several of the points in the material expanded.	1	2	3	4
8. It was fascinating to me to learn new information.	1	2	3	4
9. When I read an item that puzzled me, I kept reading it until I understood it.	1	2	3	4
10. I enjoyed learning new words and their meanings.	1	2	3	4
11. I found myself getting tired of reading about the same subject.	1	2	3	4

Name _____
Page 2

	Not at all	Somewhat	Moderately So	Very Much So
12. When I came across a word I didn't understand, I tried to figure out its meaning.	1	2	3	4
13. Sometimes I found it difficult to concentrate on this material.	1	2	3	4
14. On the difficult material I had trouble paying attention.	1	2	3	4
15. I found myself trying to anticipate what the next problem would be.	1	2	3	4
16. If the material was familiar to me, I found myself enjoying it more.	1	2	3	4
17. I found myself getting bored when the material was redundant.	1	2	3	4
18. It was exciting to me to learn more about this subject.	1	2	3	4
19. The material stimulated me to think of new ideas.	1	2	3	4
20. I found that I would rather spend time answering difficult questions than spend it with easy ones.	1	2	3	4

SCS: STUDY I

Name _____ Date _____

DIRECTIONS: A number of statements which people have used to describe themselves are given below. Read each statement and then circle the appropriate number to the right of the statement to indicate how you felt while learning the materials.

There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to best describe how you felt.

	Not at all	Somewhat	Moderately So	Very Much So
1. The material I learned was very interesting to me.	1	2	3	4
2. I enjoyed learning the material which was unfamiliar to me.	1	2	3	4
3. I felt that the material was boring.	1	2	3	4
4. When the material was difficult, I did not enjoy learning it.	1	2	3	4
5. I thought it was fun to increase my understanding about the subject matter.	1	2	3	4
6. I would enjoy reading more about this subject matter.	1	2	3	4
7. I would like to see several of the points in the material expanded.	1	2	3	4
8. It was fascinating to me to learn new information.	1	2	3	4
9. When I read an item that puzzled me, I kept reading it until I understood it.	1	2	3	4
10. I enjoyed learning new words and their meanings.	1	2	3	4
11. I found myself getting tired of reading about the same subject.	1	2	3	4

Name _____
Page 2

		Not at all	Somewhat	Moderately So	Very Much So
12.	When I came across a word I didn't understand, I tried to figure out its meaning.	1	2	3	4
13.	Sometimes I found it difficult to concentrate on this material.	1	2	3	4
14.	On difficult questions I found it difficult to make correct decisions.	1	2	3	4
15.	I found myself trying to anticipate what the next problem would be.	1	2	3	4
16.	I felt more comfortable when the material was familiar to me.	1	2	3	4
17.	I found myself getting upset when the material was redundant.	1	2	3	4
18.	I tried to think of alternative answers to some of the problems.	1	2	3	4
19.	The material stimulated me to think of new ideas.	1	2	3	4
20.	I found that I would rather spend time answering difficult questions than spend it with easy ones.	1	2	3	4

APPENDIX

B

REVISED FORMS OF THE STATE CURIOSITY SCALE

STATE CURIOSITY SCALE - Form A

Name_____ Date_____

DIRECTIONS: A number of statements which people have used to describe themselves are given below. Read each statement and then blacken the appropriate space on the IBM answer sheet to indicate how you think you would feel while learning new materials.

There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe best how you think you would feel.

	Not at all	Somewhat	Moderately so	Very much so
1. The material will be very interesting to me.	1	2	3	4
2. I will enjoy learning the material which is unfamiliar to me.	1	2	3	4
3. I feel that the material will be boring.	1	2	3	4
4. I will enjoy reading more about the new materials.	1	2	3	4
5. When the material is difficult, I will not enjoy learning it.	1	2	3	4
6. I think it will be fun to increase my understanding about the subject matter.	1	2	3	4
7. I will like to see some of the points in the material expanded.	1	2	3	4
8. I will enjoy learning new words and their meanings.	1	2	3	4

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	Not at all	Somewhat	Moderately so	Very much so
9. Sometimes I will find it hard to concentrate on the material.	1	2	3	4
10. It will be fascinating to me to learn new information.	1	2	3	4
11. I will find myself losing interest when complex material is presented.	1	2	3	4
12. When I read a sentence that puzzles me, I will keep reading it until I understand it.	1	2	3	4
13. I will enjoy learning the material that surprises me and makes me change my old ideas about the subject.	1	2	3	4
14. It will be more enjoyable to me to read about familiar than unfamiliar material.	1	2	3	4
15. I will have trouble paying attention on the difficult material.	1	2	3	4
16. The material will stimulate me to think of new ideas.	1	2	3	4
17. I will find that I would rather spend time answering difficult questions than spend it with easy ones.	1	2	3	4
18. When I come across something I don't understand, I will try to figure it out.	1	2	3	4
19. It will be exciting to me to learn about the subject.	1	2	3	4
20. I will find myself getting bored when the material is redundant.	1	2	3	4

STATE CURIOSITY SCALE - Form B

Name_____ Date_____

DIRECTIONS: A number of statements which people have used to describe themselves are given below. Read each statement and then blacken the appropriate space on the IBM answer sheet to indicate how you felt while learning the materials.

There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe best how you felt.

	Not at all	Somewhat	Moderately so	Very much so
1. The material I learned was very interesting to me.	1	2	3	4
2. I enjoyed learning the material which was unfamiliar to me.	1	2	3	4
3. I felt that the material was boring.	1	2	3	4
4. I would enjoy reading more about this subject matter.	1	2	3	4
5. When the material was difficult, I did not enjoy learning it.	1	2	3	4
6. I thought it was fun to increase my understanding about this subject matter.	1	2	3	4
7. I would like to see some of the points in the material expanded.	1	2	3	4
8. I enjoyed learning new words and their meanings.	1	2	3	4
9. Sometimes I found it hard to concentrate on this material.	1	2	3	4

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	Not at all	Somewhat	Moderately so	Very much so
10. It was fascinating to me to learn new information.	1	2	3	4
11. I found myself losing interest when complex material was presented.	1	2	3	4
12. When I read a sentence that puzzled me, I kept reading it until I understood it.	1	2	3	4
13. I enjoyed learning the material that surprised me and made me change my old ideas about this subject.	1	2	3	4
14. It was more enjoyable to me to read about familiar than unfamiliar material.	1	2	3	4
15. I had trouble paying attention on the difficult material.	1	2	3	4
16. The material stimulated me to think of new ideas.	1	2	3	4
17. I found I would rather spend time answering difficult questions than spend it with easy ones.	1	2	3	4
18. When I cam across something I didn't understand, I tried to figure it out.	1	2	3	4
19. It was exciting to me to learn about this subject.	1	2	3	4
20. I found myself getting bored when the material was redundant.	1	2	3	4

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